

Remarks

Applicants respectfully request reconsideration of the present application in view of the above amendment and following remarks. Claim 1 has been amended. No claims have been cancelled or added. Claims 15-24 were withdrawn. Therefore, claims 1-10, 13 and 14 are pending in the present application.

Claim 1 has been rejected under 35 U.S.C. § 102 as being anticipated by EP 1,047,144 to Botti et al and U.S. Patent No. 6,609,582 to Botti et al. Since the content of both of these references are substantial duplicates of one another, they will collectively be referred to as the Botti reference. Applicants respectfully traverse this rejection in view of the above amendment.

Amended claim 1 is directed to a method of main reformer startup. The method includes introducing a first supply of fuel and a first supply of air into a micro-reformer to produce a heated reformat in the micro-reformer, directing the heated reformat through a main reformer to heat the main reformer, burning at least a portion of the heated reformat in the main reformer, increasing the first supply of fuel and the first supply of air to the micro-reformer to increase the amount of heated reformat directed to the main reformer, and introducing a second supply of fuel and a second supply of air to the main reformer to produce a main supply of reformat.

The Botti reference does not teach or suggest a method including introducing a first supply of fuel and a first supply of air into a micro-reformer to produce a heated reformat in the micro-reformer, directing the heated reformat through the main reformer to heat the main reformer, and then increasing the first supply of fuel and the supply of air to the micro-reformer to increase the amount of heated

reformat directed to the main reformer as recited in amended claim 1. By providing a lower flow rate of fuel and air initially, which produces a heated reformat that flows from the micro-reformer through the main reformer, the heated reformat is able to keep the main reformer at a threshold temperature where hydrogen and carbon monoxide aggressively react. See *Specification*, pg. 9, lines 19-25. Under these conditions, the start-up of the main reformer can be essentially instantaneous. See *id.* at lines 26-28. Subsequently increasing the flow rate in the micro-reformer, and then adding air and then a fuel in the main reformer, allows the main reformer to produce a high flow rate of reformat within a short period of time (i.e., a few seconds). See *id.* at lines 28-30.

In rejecting claim 1, the Examiner stated that during start-up of any reactor the reactant supply is always increased over a period of time from the initial amount of the reactant reaches the reactor until the desired reactant flow rate is reached. See *Final Office Action*, pg. 7. Therefore, the Examiner is taking the position that the Botti reference does provide for an increase in fuel flow since the amount of flow that is conveyed from the supply (9) to the start-up reformer (10) at some point increases from zero to a certain flow value. Based on this interpretation of the inherent teachings of the Botti reference, the Examiner has taken the position that the Botti reference discloses that the step of introducing a first supply of fuel and a first supply of air into a start-up reformer at a first flow rate. However, there is nothing to indicate that the Bottie reference explicitly or inherently discloses that the fuel and air supply in the micro-reformer is increased, after the heated reformat is directed through the main reformer based on the aforementioned lower flow rate,

thereby allowing the main reformer to produce a high flow rate of reformat within a short period of time. Such an increase in flow rate to the micro-reformer to increase the amount of heated reformat flowing to the main reformer, in the sequence set forth in amended claim 1, is not present in the Botti reference. Since the Botti reference fails to teach or suggest all of the limitations included in amended claim 1, Applicants request that the rejection of claim 1 be withdrawn.

Claims 4 and 6-10, 13 and 14 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over the Botti reference. Applicants respectfully traverse this rejection.

As stated above, the Botti reference does not teach or suggest a method including increasing the first supply of fuel and the supply of air to the micro-reformer to increase the amount of heated reformat directed to the main reformer as recited in amended claim 1. Since claims 4, 6-10, 13 and 14 depend either directly or indirectly from claim 1, these claims are not taught or suggested for at least the same reason set forth above with respect to claim 1.

In rejecting claims 4, 13 and 14, the Examiner recognizes that the Botti reference does not disclose specific catalyst volumes for the start-up reformer (10) relative to the main reformer. See *Final Office Action*, pg. 3. Given the lack of specific facts providing the catalyst volumes for the start-up reformer (10) relative to the main reformer, the Examiner pointed to FIG. 1 of the Botti reference stating that the start-up reformer (10) is shown as being significantly smaller than the main reformer. See *id.* at pg. 3. Further, the Examiner noted that the engine (30)

disclosed in the Botti reference is a reformer, as it is configured to produce hydrogen rich engine exhaust. *See id.* pg. 8.

First, Applicants would like to clarify a statement the Examiner made regarding the Applicants' position in the Final Office Action. Specifically, the Examiner stated that the "applicant argues that in Botti et al. the reformat from the start-up reformer is provided to the engine (30) so that the engine can produce shaft power and not to the main reformer" *Final Office Action*, pgs. 7-8. Applicants did not take the position that the start-up reformer does not provide reformat to the engine (30) to produce hydrogen rich engine exhaust (50) or reformer exhaust (20). Instead, as set forth in the previous response, Applicants stated that the start-up reformer (10) in the Botti reference provides reformat to the engine (30) to produce both shaft power and hydrogen rich engine exhaust (50) or reformer exhaust (20) which is used as fuel for the fuel cell (40). *See Response to Office Action Dated January 11, 2005*, pg. 10; *see also Botti*, Col. 4, lines 58-62; Col. 5, lines 1-15; Col. 9, lines 53-57.

Second, Applicants respectfully disagree with the Examiner's position that the engine (30) is acting solely as a reformer. Applicants do not disagree that a reformer is one component included within the engine (30). The Botti reference states:

Within the engine (30), air (63), reformat (21) and/or other fuel (11) are burned to produce shaft power, while hydrogen rich engine exhaust (50) or reformer exhaust (20) is used as fuel in the SOFC (40). The engine 30 can be any conventional combustion engine configured to produce hydrogen rich engine exhaust to feed a SOFC 40 including,

but not limited to, internal combustion engines such as gas turbine, spark ignited and compression ignited engines, including, but not limited to, variable compression engines. Preferably, the engine has been modified to include one or a combination of rich combustion devices, including, but not limited to, free piston gas generators with super rich HCCI combustion, oxygen separators with rich IC cylinder systems having enhanced rich combustion in all or part of the engine and, optionally, HCCI, and extremely rich, preheated inlet turbo-generator systems having a one- or two-stage combustion system.

Botti, Col. 9, lines 53-67; Col. 10, lines 1-3. However, in the description of the engine (30) set forth above, it cannot be ignored that the engine is: 1) specifically described as producing shaft power (Col. 9, line 55); 2) described as being an internal combustion engine such as a gas turbine spark ignited and compression ignited engines, including variable compression engines (Col. 9, lines 57-62); and 3) shown in FIG. 1 as being associated with a motor generator (110) and providing power to electrical accessories (100) and traction power and mechanical accessories. While the engine (30) may be in part acting as a reformer to reform hydrogen containing fuel to provide hydrogen rich exhaust to fuel the fuel cell (40), Applicants submit that the engine (30) also includes non-reformer components that use the reformat from the start-up reformer (10) as an energy source for shaft power and non-fuel cell components.

Since the engine (30) in the *Botti* reference includes components in addition to a main reformer, it would be improper to compare the relative sizes of the start-up reformer (10) and the engine (30) shown in FIG. 1 to teach or suggest the limitations

included in claims 4, 13 and 14. For at least this reason, Applicants request that the rejection of claims 4, 13 and 14 be withdrawn.

The Examiner also states that the only difference between the Botti reference and the claimed invention is a recitation of the relative dimensions of the claimed invention. *See Final Office Action*, pg. 4. Since it was determined by the Examiner that the claimed device does not perform differently from the system disclosed in the Botti reference, the Examiner concluded that the claimed invention is not patentably distinct from the Botti reference. *See id.* In support of the argument that the claimed device does not perform differently from the system disclosed in the Botti reference, the Examiner states that the Botti reference does in fact disclose that at least a portion of reformat (21) produced by the start-up reformer (10) is burned in the engine (30). *See id.* at pg. 8, lines 14-16. While a portion of the reformat produced by the start-up reformer (10) may be used to produce hydrogen rich engine exhaust (50) or reformer exhaust (20) as suggested by the Examiner, the amount of reformat sent to the engine (30) also depends on shaft power demand on the engine (30). *See Botti*, Col. 9, lines 53-57. In the present invention, the reformat provided by the micro-reformer is not used to produce shaft power, but is instead used to heat up devices (e.g., a main reformer) located downstream of the micro-reformer. Since the demands on the start-up reformer (10) in the Botti reference are different than in the present invention, the system in the Botti reference performs differently than the claimed invention, and the Botti reference does not suggest the catalyst volumes in claims 4, 13 and 14. For this additional reason, Applicants request that the rejection of claims 4, 13 and 14 be withdrawn.

Regarding claims 6, 7 and 9, the Examiner has relied on a "result effective variable" as an indicator that the aforementioned claims are obvious in view of the Botti reference. See *Final Office Action*, pgs. 4-5, 8-9. A result effective variable is defined as a variable which achieves a recognized result. See MPEP 2144.05. In the Botti reference, the fuel equivalency ratios in the start-up reformer (10) in part based upon the desired amount of shaft power to be produced by the engine (30) and the amount of hydrogen rich engine exhaust (50) or reformer exhaust (20) that needs to be provided to fuel the fuel cell (40) upon start-up of the system. See *Botti*, Col. 4, lines 58-62; Col. 9, lines 53-57. The Botti reference does not suggest that the fuel equivalency ratios in the start-up reformer (10) are a function of the warm-up time of the main reformer in the engine (30). Since the function of the start-up reformer (10) is not identical to the micro-reformer in the present invention, the fuel equivalency ratios in the start-up reformer (10) are not recognized in the Botti reference to be a result effective variable. See *In re Antonie*, 195 USPQ 6 (CCPA 1977) (stating that the prior art did not recognize that treatment capacity is a function of tank volume to contractor ratio, and therefore the parameter optimized was not recognized in the art to be a result effective variable). For these additional reasons, Applicants request that the rejection of claims 6, 7 and 9 be withdrawn.

Claims 2 and 3 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over the Botti reference in further view of U.S. Patent No. 4,391,794 to Silberring ("the Silberring reference"). Claim 11 has been cancelled, therefore the rejection of this claim is moot.

The Silberring reference fails to add anything to the Botti reference except to provide a reforming apparatus having a recuperator, a reactor chamber and a heater disposed in a common pressure shell. *See Silberring*, Abstract. As with the Botti reference, the Silberring reference fails to teach or suggest a method including increasing the first supply of fuel and the supply of air to the micro-reformer to increase the amount of heated reformat directed to the main reformer as recited in amended claim 1. As claims 2 and 3 depend from claim 1, these claims are also not taught or suggested by the references of record for at least the same reason set forth with respect to claim 1.

Claim 5 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over the Botti reference in further view of U.S. Patent No. 5,858,314 to Hsu ("the Hsu reference").

The Hsu reference fails to add anything to the Botti reference except to provide a reformer having a stack of thermally conducting plates interspersed with catalyst plates. *See Hsu*, Abstract. As with the Botti reference, the Hsu reference fails to teach or suggest a method including increasing the first supply of fuel and the supply of air to the micro-reformer to increase the amount of heated reformat directed to the main reformer as recited in amended claim 1. Since claim 5 depends from claim 1, this claim is also not taught or suggested by the references of record for at least the same reason set forth with respect to claim 1.

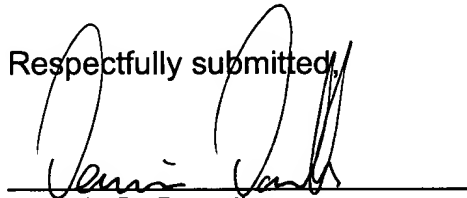
Conclusion

In light of the foregoing, Applicants submit that claims 1-10, 13 and 14 are in condition for allowance and such allowance is respectfully requested. Should the Examiner feel that any unresolved issues remain in this case, the undersigned may be contacted at the telephone number listed below to arrange for an issue resolving conference.

Applicants do not believe that any fee is due at this time. However, the Commissioner is authorized to charge any fee that may have been overlooked to Deposit Account No. 10-0223.

Dated: 9/13/05

Respectfully submitted,



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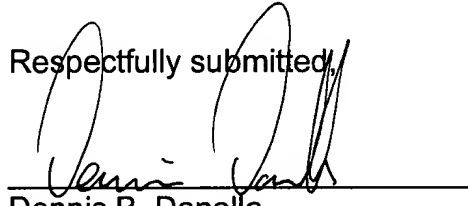
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